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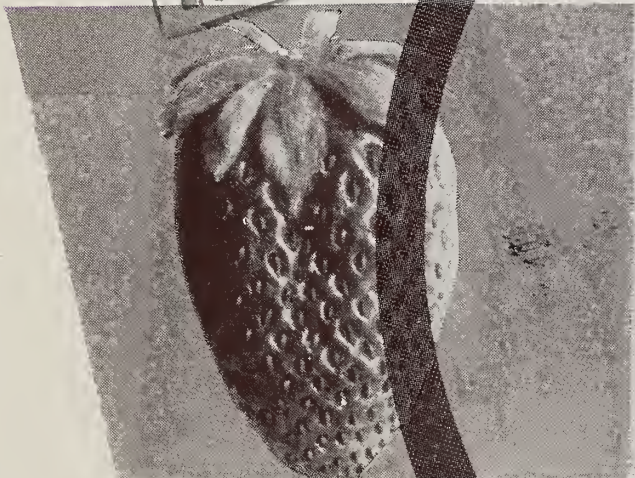
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AGRICULTURAL Research

JUNE 1957
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BIGGER FRUIT
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U. S. DEPARTMENT OF AGRICULTURE



FEWER FIRES
see page 8



FINER LEATHER
see page 13

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL Research

Vol. 5—June 1957—No. 12

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Jobs for research

Agricultural research must benefit farmers—that *responsibility* never changes. It's the same in all kinds of times.

But the times do influence the *emphasis* in our agricultural research. Today, we face three urgent research jobs:

1. Protecting what we already have.

That means protecting our natural resources—our soil and water—and protecting our productive capacity. In the humid region, for example, rain-dependent farmers lose a third of the water as runoff; research is developing cropping systems and tillage practices that get more rain into the soil.

Another way to protect our farm productivity is through research and regulation that give us better pest control.

Obviously, we put considerable time, money, and energy into efforts that succeed only in reducing losses or in returning productive capacity to where it had been.

At the same time, we often get the extra research dividend that results in more efficient farm production. Where research does lead to increased productive capacity, we are making progress toward our second important objective:

2. Helping farmers balance production and make a living.

Research that increases production efficiency not only betters a farmer's competitive position but also offers him more opportunities for changes. Certainly, as research brings livestock into line with crops in terms of production efficiency, more farmers will be inclined to shift to livestock.

In turn, all these gains will strengthen our approach to our third important research objective:

3. Building for the future.

Looking into that future only as far as 1975, we see a need for an estimated 25 percent increase in farm output to meet the requirements of our expanding population.

We must keep in mind that research takes time. It's research planned and initiated now that will enable farmers to meet the needs of future years with essentially the same soil and the same water resources we now have.

We must learn to produce and use more from each acre. That takes research—production, utilization, and marketing.

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FINDING SMALL FRUIT TREASURES

Giant berries from the Andes offer plant breeders important new plasm



TWO PRIZE FRUITS collected high in the Andes are the strawberry *Fragaria chiloensis* from Chile and blackberry *Rubus macrocarpus* from Colombia. Both appear in natural size.

■ **STRAWBERRIES** AND blackberries bearing giant-sized fruits have been collected in South America by USDA horticulturist G. M. Darrow. They may have important characters to breed into our domestic fruits.

Both native and improved strawberries were collected in Chile. They are forms of the species *Fragaria chiloensis*, which is one ancestor of our cultivated strawberries. Darrow's large collection of plants and seeds should have some features not found in the ancestral plants or in the strawberries we raise today.

Although *F. chiloensis* strawberries do not meet our taste standards, there are several reasons, in addition to largeness of fruit, to be interested in the introductions. They grow under such diverse conditions as long dry seasons, heavy rainfall, mild coastal temperatures, and rigors of the Andes Mountains up to timberline. They're even found within 1,500 feet of permanent snowline, where fruits ripen even after freezing weather.

Strawberries resist disease

Chilean strawberries appear to be relatively disease resistant. The fruits are remarkably firm—firm enough to

pick and handle in bushel baskets. Most of the wild berries have another asset: they can be capped easily.

Blackberries are big, hardy

A promising giant blackberry of the species *Rubus gachetensis* was collected from a prolific growth at 10,500 feet on a dry slope of the Andes near Bogota, Colombia. The raspberry-shaped fruit wasn't ripe, but local botanist J. M. Idrobo says it reaches 2 inches in length, has drought resistance and good quality.

Another fine blackberry—slightly larger fruited—was *R. macrocarpus*, collected near Bogota at 9,000 feet. Two days earlier (January 24, 1957) Darrow had collected possibly the same species at 10,800 feet on Mt. Pichincha near Quito, Ecuador. The specimen had 42 buds, flowers, and fruits in one cluster—fruits large and deep-wine colored long before ripening. It might be a different species—another prize for breeders.

The prize plant of all was an *R. roseus* collected in a fairly dry location at about 9,000 feet on the side of Volcano Tungurahua near Bannos, Ecuador. It, too, had 42 buds and fruits in a cluster and other clusters

on the same plant. Darrow was encouraged to find there a sterile plant that apparently was a hybrid of *R. roseus* with a common local species. So *R. roseus* will cross, and possibly the Colombian species will, too.

These blackberries live under shorter days at the Equator than we have in the spring. Our plant breeders couldn't make previous introductions of equatorial blackberries bloom for crossing. The Darrow collection went, therefore, to scientists with blackberries already in flower.

Crosses offer big potential

Crossing these species of blackberries and strawberries with our own may make a big contribution to our small-fruit industry. Increasing fruit size would cut harvest cost—a major problem in fruit production. Increased disease resistance could be another dividend. Drought tolerance and the hardiness that made these fruits thrive in cold, dry mountain climates could increase the range and dependability of our fruits. Firmer strawberries would ship and store better and reach consumers with less waste. We can hope for all these advantages—and hidden ones, too. ☆

Sesame...

OLD CROP WITH NEW LIFE

Genetic improvement in shatterability, yield, quality, range, and other features brighten prospects for a Cotton Belt crop

■ NEW VARIETIES of sesame and new methods of producing it may make this Old World crop of major importance to our southern agriculture.

Sesame was one of the first oil-seed plants ever cultivated by man. Native of India and Africa, the plant produces seeds in which nature packed a vast amount of benefit for mankind in the form of oil, protein, vitamins, and certain necessary minerals.

As a source of high-quality edible oil, food for humans, and feed for animals, sesame has virtues known in many part of the world for centuries. Expanding uses are bringing the seed and its oil greater industrial prominence in the United States.

New and improved varieties of sesame have been developed and tested by USDA, State, and industry plant scientists. Much of this cooperative research has been done at the Texas Agricultural Experiment Station, College Station, under direction of ARS agronomist M. L. Kinman. The researchers have sought greater adaptation of the plant to mechanized production, greater resistance to disease and other hazards, better seed quality and flavor for specialty whole-seed or oil-seed processing, greater ease of threshing, and more specific adaptation to various growing conditions. Some progress has been made.

Shattering was big problem

Sesame is a dehiscent plant—the seed capsules burst open by themselves when dry. This has made the crop

more suitable for production by hand labor than by mechanized means.

From indehiscent plants found in South America, however, scientists have developed varieties that are nonshattering. One called Rio is best adapted to the Southwest, was first produced there in 1955. Rio's seeds are normally a dull white but tend to discolor under some conditions. Their flavor is acceptable and their oil and crude protein yield are high (49 and 28 percent respectively).

New varieties are released

A nonshattering variety released this spring, Delco, is adapted only to areas where dry fall weather can be expected. It is easy to thresh. Seed of Delco has been distributed to qualified growers of certified seed, and adequate quantities for commercial plantings are indicated for 1958.

Research is following up to incorporate many other desirable characteristics in nonshattering plants through crossbreeding and selection. Scientists want to give nonshattering types the greater ability to yield seed and oil as well as the better seed color, flavor, and protein that many long-known shattering types possess.

Meanwhile, shattering types are not being neglected. Solution of many of the mechanical problems of harvesting has made their growth feasible. As a result, three new ones were released this spring—Margo, Blanco, and Dulce. Seed stocks of Blanco were adequate for commercial plant-



SEED-BEARING CAPSULES at base of sesame leaves normally burst open when dry and seeds are easily lost. But scientists have bred new nonshattering varieties that can be threshed from a windrow by tractor-drawn combine fitted with a pickup attachment (above). Shattering types are often shock threshed (below) to cut seed losses.



NONSHATTERING



SHATTERING



ings this year, and certified seed of Margo and Dulce will be available for 1958. These three new shattering varieties will eventually help supply annual requirements for about 3,000 tons of whole seed used in confections, bakery goods, and condiments.

(Foundation seed of the four new varieties is available only from the Texas station—not from USDA.)

Southwest gets high yields

Sesame is a unique crop. It is not for poor land. But properly fertilized, it will thrive in Texas, Arkansas, and New Mexico, where some 15,000 acres are in production. Yields range up to 1,200 pounds of seed an acre compared with a world average of about

260 pounds. Experimentally, the plant has produced more than 2,000 pounds an acre—this on desert land under irrigation conditions.

Sesame also does well in the Southeast. It is grown here largely on a noncommercial scale for its attractive flowers and for the seed, which is used in benne (sesame) cakes, a traditional cookie in this part of the country.

It will grow and produce satisfactorily as far north as southern Nebraska. Generally, however, temperature and growing conditions limit the crop to the Cotton Belt. Although resistant to drought, it needs water. But sesame does not tolerate "wet feet," or the heavy salt accumulations encountered in some irrigated areas.

Industry has found in the oil unique properties that make it act as a synergist to increase the effectiveness of pyrethrin insecticides. There is also need for the oil as a carrier of penicillin and in making such items as cosmetics, perfumes, and soaps.

These uses are in addition to long-established outlets for whole seed and for oil used in salads or cooking—growing outlets now met barely halfway by our commercial production.

Combined oil and protein content of sesame seed is probably greater than in any other edible vegetable seed or nut. The average is near 50 percent oil and 25 percent protein (some varieties run far higher in both).

Meal is valuable byproduct

Meal left after the oil is extracted is a valuable byproduct. Like the whole seed, it is a rich source of protein, calcium, phosphorus, and niacin. The protein is especially high in the amino acid methionine, needed in poultry rations. Combined with peanut or soybean meal, which normally lack sufficient methionine, sesame seed meal provides a nearly complete protein supplement for most farm animals. By itself, the meal is a satisfactory source of protein for ruminants. Possibilities of the whole seed or meal in human diet are by no means limited to present applications.

World production of sesame seed is fairly constant at about 3 billion pounds a year. Our imports, largely from Nicaragua and El Salvador, have ranged from 9 to 24 million pounds annually since World War II.

Our annual commercial production, used both as whole seed and oil, amounts to about 10 million pounds on some 15,000 acres. This output is expected to increase materially as seed of new varieties becomes available for commercial plantings. ☆

Parasites and Winter Pasture



Calves overwintered on fescue get too little nourishment to combat worms, don't gain well

■ CALVES ON FESCUE pasture had more worms or showed more ill effects of worm infection than comparable animals on temporary winter or crimson clover pasture, in work by USDA and the Georgia Agricultural Experiment Station, Experiment, Ga.

At least partly responsible was the lower nutritive quality of the fescue. The high nutritive quality of crimson clover forage and a temporary forage mixture was a factor in checking the harmful effects of parasites, even when large numbers of them were picked up on these pastures.

Development of better and more extensive winter grazing in the South has focused attention on internal parasites. Beef calves previously sold in the fall as baby beef or wintered in feedlots are now often grazed on winter pastures for spring sale. Forage is the carrier of most ruminant worm infections. And southern climate favors not only establishment and growth of winter grazing but also propagation of these parasites.

Studies cover several years

Long-range studies were begun in Georgia several years ago to deter-

mine the relationships between internal parasitism and winter pasture, supplemental feeding, and calf age.

Hereford calves were placed on 3 types of winter pasture: (1) temporary (ryegrass, oats, and crimson clover), (2) fescue and white clover, and (3) crimson clover. Some of the animals received supplemental corn. Spring-dropped and fall-dropped calves were checked for any differences in worm infection because of different levels of resistance to worms.

Fescue-fed calves hard hit

In general, calves on fescue showed clinical symptoms of parasitism, such as rough and dull hair coats, diarrhea, and emaciation. Symptoms were especially severe in animals grazing fescue without supplemental corn, and in spring-dropped calves on fescue. None of the calves on crimson clover or temporary pastures ever showed symptoms of clinical parasitism, regardless of the worm loads that were established in these experiments.

Without corn supplement, calves on fescue had more worms and gained less than unsupplemented calves on the temporary mixture or crimson

clover forage. Most of the unsupplemented calves on fescue showed some pathological symptoms of the stomach at post mortem—swelling, inflammation, or pyloric hemorrhages. No symptoms were observed in animals on temporary forage. At most, only moderate inflammation of the stomach showed in animals on crimson clover.

Forage can give protection

When calves on fescue got supplemental corn, they had only one-third as many worms as calves on fescue alone, made larger gains, and ate slightly more forage. Feeding of supplemental corn to animals grazing temporary and crimson clover pastures neither increased gains nor influenced forage consumption significantly, even though worm loads were reduced. So it was better nutrition—not any decrease in forage consumption—that resulted in lower worm loads for all cattle given corn. Results also showed that the quality of the temporary and crimson clover forages was high enough to prevent adverse effects in unsupplemented calves despite their greater worm loads. And fescue alone, the experiment shows, furnishes inadequate protection against worm parasitism.

Spring-dropped calves had 2 to 3 times more worms than fall-dropped calves. A spread of only 2 months in calving time was enough to make a big difference in worm infection.

Fall dropping of calves seems to help control parasitism during the next year's growth and finishing. It would be most practical where cattlemen have good winter pastures or a good feeding plan for their cows in late fall and early winter.

When weather is favorable to parasitism—warm winters and wet springs—worm infection may be high regardless of kind of pasture. At such times especially, a pasture's nutritive value may determine whether calves resist worm infection. ☆

WHAT LURES THE

Gypsy Moth?

Chemists seek synthetic substitute for material being used to toll unwary male moths into traps

■ WHILE SPECIALISTS spray forest areas infested with the gypsy moth (AGR. RES., May 1957, p. 8), chemists are working with entomologists to develop a synthetic attractant to replace the costly lure now used.

The USDA and State eradication effort under way in the Northeast, and along the fringe areas of the infestation in Pennsylvania, New York, and New Jersey, depends on use of a natural lure to determine the location of gypsy moth infestation and the efficiency of the spraying.

Filters impregnated with an extract of tips clipped from the body of the female moth are used in traps to lure the male moths. (Twelve tips, costing 4 cents each to collect in the United States, are required to bait each trap.) ARS technicians collect the pupae and fly them to field laboratories. The pupae are kept in trays until the moths emerge. Then the last two segments of the female body, containing the attractant, are snipped, soaked in benzene, and chemically processed. The material is stored until placed in special traps. (Tips also are collected in Yugoslavia, Portugal, and Spain.)

Females develop attractant

Scientists take advantage of the fact that the existence of the species is dependent on this sex attractant. The female moths are too heavy to fly, but they develop an attractant within 24 hours. Males, which have antennae to detect the scent of the females, are attracted half a mile, sometimes farther, for mating.

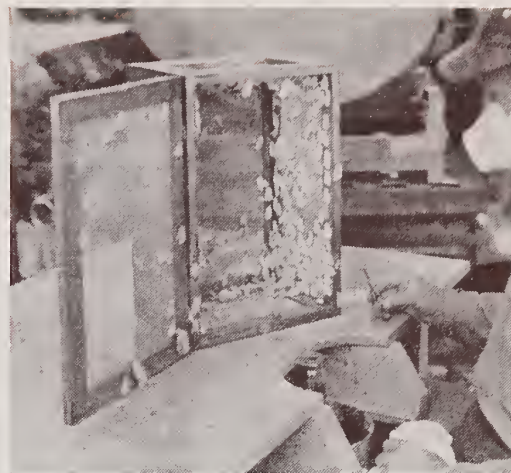
Researchers isolated the chief attractant material, "gyptol," in 1953. The painstaking basic work was started by chemist Fred Acree, Jr. The study has recently been reactivated under chemist Morton Beroza. Scientists are isolating more and trying to obtain the attractant "gyptol" in the purest form. Then, the chemical structure can be determined.

Isolation effort continues

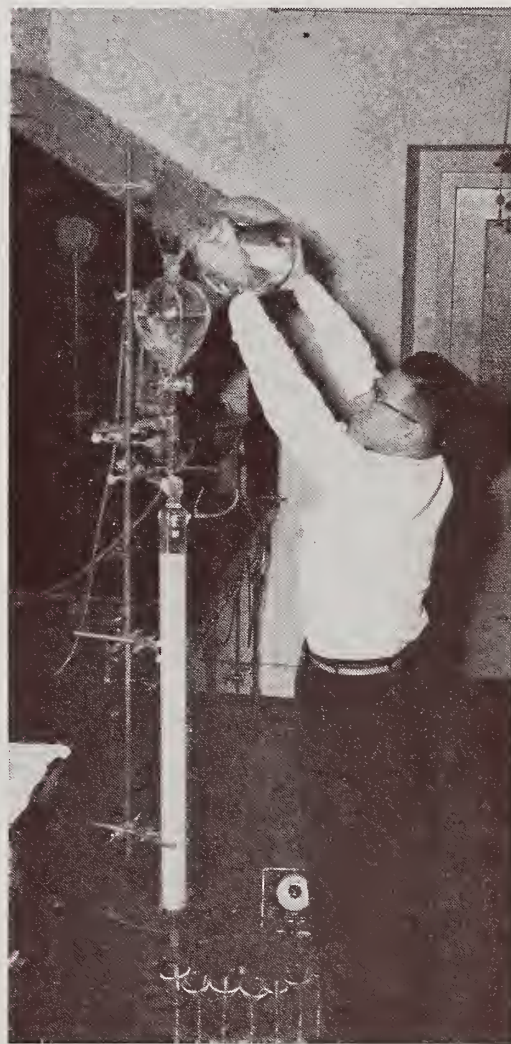
Some 200,000 virgin moth tips were collected for the purpose. Researchers at the Agricultural Research Center, Beltsville, Md., are in the process of concentrating the attractant by chromatography (AGR. RES., April 1956, p. 8). When they complete the work, they expect to have 2 drops of the pure attractant weighing about 20 milligrams each for further study.

Progress in obtaining the attractant has been hampered. Chemists can test different solutions from the chromatography bands only during the 2 weeks each summer when moths seek mates. Up-to-date mass rearing has been difficult because of wilt disease, a virus infection that destroys the insects. Forest Service entomologists plan to install equipment at a laboratory in New Haven, Conn., preparatory to experimenting on improved methods of raising the insects.

If researchers developed a laboratory method of rearing the larvae, lure testing could be done the year round. This would speed up the experiment and perhaps lead to production of a workable synthetic attractant. ☆



ATTRACTANT MATERIAL is clipped (for trap lures and experiments) from the tip of the female's body when she emerges from the pupa in late July or August. Normally, eggs are laid in July and August. The following spring, larvae emerge, feed on foliage. In late June or early July, caterpillars pupate.



DISSOLVED ATTRACTANT is isolated by chromatography. Morton Beroza pours an organic solvent with a finely powdered adsorbent into a glass column. Then, the attractant is filtered through the column. Ingredients separate and form various bands distinguished by an ultraviolet spectrophotometer.

Project

SKYFIRE

Scientists are studying cloud seeding as a means of controlling electrical storms in the West before they set in.

■ FORESTERS AND METEOROLOGISTS are trying to reduce western forest fires by studying lightning behavior and seeding clouds to prevent lightning. Since 49 percent of forest fires in the West are caused by lightning, Federal, State, and private agencies are working together to find better ways of fighting this menace.

The experiments, called Project Skyfire, include studying the buildup and behavior of fire-setting lightning storms, developing electronic means of lightning detection, and devising techniques for the possible prevention of lightning fires through cloud seeding.

Project Skyfire field experiments will be conducted June through September on the Idaho and Montana sides of Lolo National Forest in the Bitterroot Range. J. S. Barrows, of USDA's Forest Service, is in charge of operations. Technical director is V. J. Schaefer, Director of Research at Muntalp Foundation, research organization participating in the work. Other cooperating groups are U. S. Weather Bureau, Montana State University, University of Washington, National Park Service, and California State Division of Forestry—each having a special role.

Meteorologists are heavily seeding supercooled clouds (those made up of water droplets and registering below 32° F.) with silver iodide. This causes ice formation in the clouds. Large doses of the chemical may inhibit vertical growth of clouds—a growth that's necessary before lightning occurs. Since little natural rainfall occurs along with lightning storms in the West, seeding the clouds would not reduce the total amount of precipitation.

Generators designed for plane, ground use

Researchers designed cloud-seeding generators, which are carried in aircraft or placed on mountain tops. Ground methods are continuous and are better for larger areas. But selection of clouds cannot be made. On the other hand, pilots select young, growing clouds, which may develop to the lightning stage. More mature masses are difficult to control. Planes are able to fly a tight circle or traverse a 3- to 4-mile stretch directly under the flat-based cumulus clouds for the seeding operation.

Preliminary tests of generators were made last summer in the Coconino National Forest near Flagstaff, Ariz., and Lolo National Forest near Missoula, Mont. Scientists were encouraged. Smooth, flat cloud bases became ragged. Ice formation was noted in cloud tops. Seeded clouds appeared to deteriorate. Some precipitation resulted but usually did not reach the ground.

Instruments developed to study atmosphere

Also tested were other research-developed instruments for measuring atmospheric conditions. These are now being used to record temperature, humidity, atmospheric electricity, and particles that may act as condensation nuclei. Air samples, taken periodically, are placed in a cold chamber aboard an aircraft for microscopic examination. After seeding, researchers check the amount of silver iodide nuclei present in the target area.

Radar is used to help detect, track, and analyze lightning storms. A mobile radar unit mounted on a trailer is driven to mountain tops. The surrounding country is scanned, and storms are followed closely.

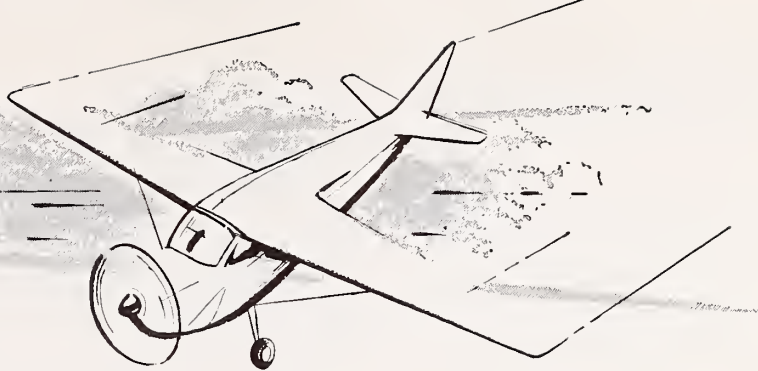
Permanently located lookout stations on the mountain tops in the northern Rockies are used for observation. Since 1953, there have been 22 stations reporting daily to the Missoula fire research station on the number of storms, lightning strikes, and fires sighted.

The recorded information represents the life cycle of lightning storms. Even time-lapse motion pictures of clouds are obtained. Project Skyfire specialists are using the information on clouds and lightning behavior for the present experiment to attempt to modify clouds, prevent lightning, and reduce forest fires.

Radar may eventually be installed on key lookout towers. Thus firefighters can be alerted to storms.

Scientists want to know where clouds move, how storm form, and what pattern they take. More basic research is needed on the mechanics of lightning, the precipitation process, and atmospheric conditions before and after storms. (Sometimes the atmosphere is dry and wind causing fires to spread violently, once they are started.)

Leaking up forest fires



Previous studies show that 100,000 lightning fires occurred from 1940 to 1955 in 12 States in the Rocky Mountains and Pacific Coast area. This includes Washington, Oregon, California, Montana, Idaho, Wyoming, South Dakota, Colorado, Arizona, New Mexico, Nevada, and Utah. Damages occurred to valuable forests, and watersheds of the Colorado, Columbia, and Missouri Rivers were depleted for long periods by the fires.

Results of this summer's efforts will be charted and presented to the President's Advisory Committee on Weather Control for evaluation. If the data warrants, the method will be considered for other areas. ☆

GENERATORS BOMBARD cumulus clouds with silver iodide—either from airplanes or the top of mountains. Researchers especially designed generators, like this one, for Project Skyfire.



BEHAVIOR PATTERNS of lightning storms are charted, and approaching cumulus clouds (young growing masses that might be controlled by seeding) are noted on charts. Reports come to Missoula, Mont., station from lookout points every day.



PILOTS FOLLOW the clouds on both sides of the Bitterroot Range, taking samples of the nuclei before and after seeding. The samples are tested in this portable cold box aboard the plane to determine amount of concentrations.



FORESTER J. S. Barrows uses a radio to guide a cloud-seeding aircraft while fellow workers record cloud data using the cloud theodolite. Information is coordinated with charts from the lookout areas.



DAIRY PRODUCTS IN THE FAMILY FOOD

■ DAIRY PRODUCTS claimed one-sixth of this country's family food bill, according to the USDA Household Food Consumption Survey, which covered 6,000 households in spring 1955 (AGR. RES., January 1957, p. 8).

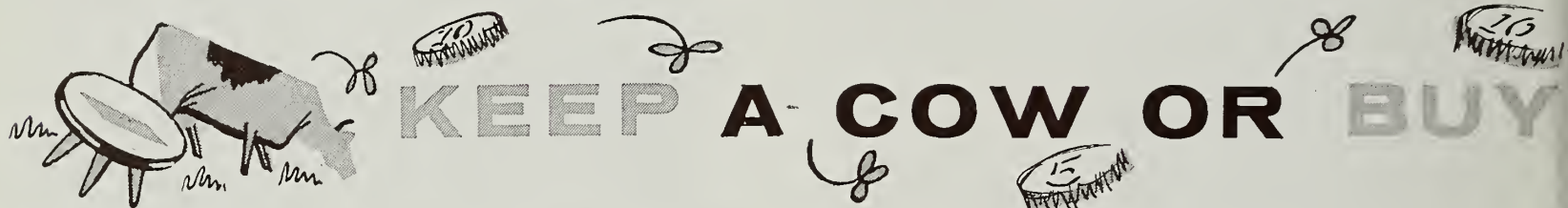
Out of \$3.62 spent weekly by the average household of one or more persons, one-half went for fluid whole milk. Butter accounted for 39 cents, and cream, ice cream, processed milk, and cheese the remainder.

Here are average amounts of some items a household used in a week: 10.0 quarts of fresh fluid whole milk; 1.0 pounds of evaporated milk; 1.1 quarts of ice cream; 1.1 pounds of cheese; and 0.7 pound of butter.

Farm families use more dairy products than city families, chiefly because farms supply so much of their own milk. Only about one-sixth of the milk that farm families use is purchased. On a nationwide basis, farm

families buy a little more than half of the butter they use.

The survey showed that regional differences in dairy product consumption were not large, especially among urban families. North Central urban households were somewhat heavier buyers of fresh fluid whole milk than those of other regions. Buttermilk and evaporated milk were more popular in the South. North Central urban families purchased the same



■ DOES IT PAY a rural family to keep a cow or two to provide the milk and butter a family needs—or is it cheaper to buy dairy products?

A way to determine the relative economy of home-produced milk has been worked out by food economist Eloise S. Cofer, in the ARS Institute of Home Economics. With this method, farm-family counselors can show the cost of milk at any level of consumption, using local prices.

Four kinds of data are needed: (1) cost of keeping a cow or cows; (2) amount of milk produced and distribution throughout the year; (3) amount of milk and milk products used by the family; and (4) value of surplus milk, if any, and of the calf.

The amount of milk used by a family should be based on nutritional requirements of each member. Recommended amounts for different ages and for pregnant and nursing women are given in USDA Home and Garden Bulletin 57, "Getting Enough Milk."

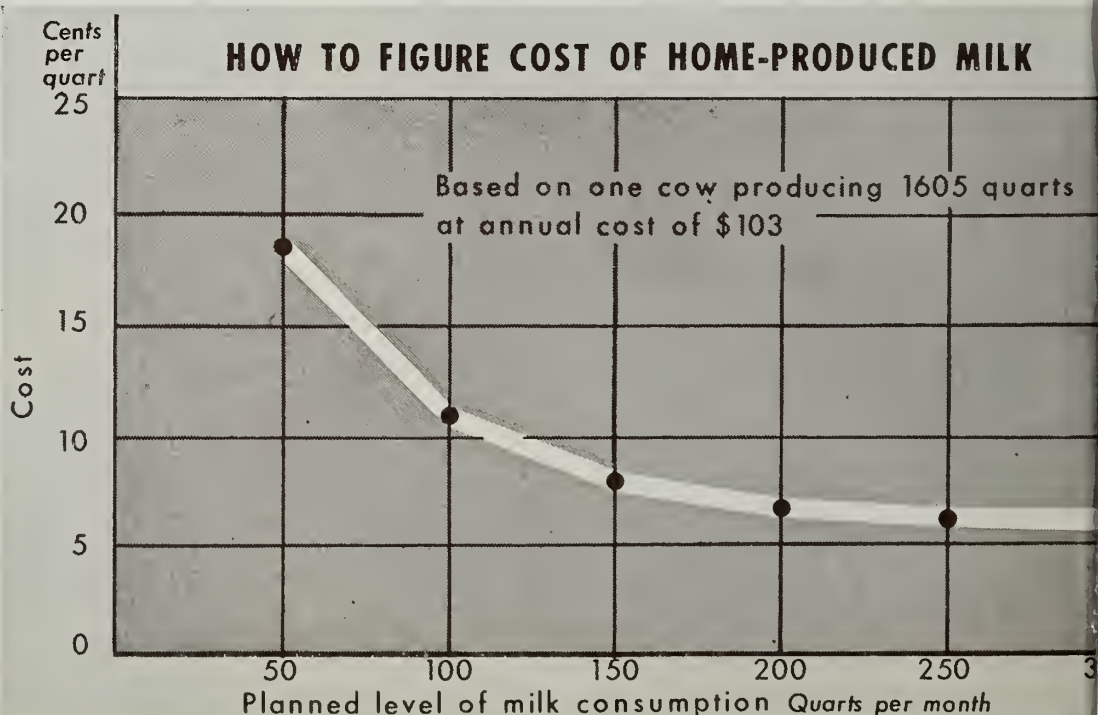
As a counselor helps a family determine the amount of milk needed, he can teach the importance of ade-

quate milk consumption—important since too little milk is one of the present weak points in American diets (AGR. RES., May 1957, p. 12). Incidentally, surveys show that families tend to consume more milk and milk products when they produce them.

The chart shows how Miss Cofer applies her method. The cost per

quart for the milk used was 7 cents—when the family's monthly consumption was 59 quarts of milk for drinking and cooking and up to 147 quarts for cream and butter. The cost per quart of cream or pound of butter was 60 cents. Comparative retail prices were 20 cents for milk, \$1.11 for cream, 78 cents for butter. In this

THIS IS THE KIND of chart a farm-family counselor might use to help families determine the economy of producing milk at home. In this example, annual feed cost, depreciation, and other expenses amounted to \$103, with no charge for labor, barn, or pasture, and \$33 credit for 200-pound calf. Cow produced 1,605 quarts of milk annually—ranging from 307 to 61 quarts a month for 9 months, none for 3 months. Surplus milk was valued as livestock feed.



BUDGET

amount of butter and a little more cheese than those in the Northeast.

Some shifts were revealed. For example, in a 1942 survey of households, 23 percent served ice cream at home at least once a week; the comparable 1955 figure was 58 percent. The proportion using cheese was also up, from 53 percent to 78 percent. Users of butter at least once a week, on the other hand, had dropped from 82 percent to 60 percent. ☆



example, the surplus whole and skim milk was valued as livestock feed.

If the family with 1 cow had used only 100 quarts of milk per month for all purposes, the cost would have run 10 cents per quart of milk and 90 cents per quart of cream or pound of butter. The more of the milk a family uses, the greater the savings.

If the same family using the same amount of milk had 2 cows freshening 6 months apart, the cost would be greater unless there was use for the surplus milk. On the credit side would be a year-round milk supply.

In this example, to gain from home-producing milk, the family must consume more than 45 quarts with 1 cow as whole milk monthly, or 75 quarts or more with 2 cows. It does not pay at this level to keep a cow for butter or cream. If the family uses 100 quarts from 1 cow or 150 quarts from 2 cows, it will profit by producing milk for drinking, cooking, and cream. Not until the 200-quart level of consumption with 1 cow—or 250 quarts with 2 cows—is the use of milk for butter profitable. ☆



DAIRY · DAIRY · DAIRY · DAIRY · DA

Calves don't need rumen inoculation

■ CATTLE, WHICH IN MATURITY use vast numbers of certain microorganisms as a team of forage digesters, apparently can get along well in calfhood with a second team of organisms. These occur naturally in the calf rumen (extra stomach enabling ruminants to digest roughage) and become most numerous in absence of organisms usually dominant.

This discovery from preliminary research at USDA's Agricultural Research Center, Beltsville, Md., indicates there's no problem with rumen microorganisms in rearing calves under isolation. Nowadays, calves are often separated from the herd shortly after birth. Some researchers have thought it necessary to inoculate such calves to establish the normal rumen flora, but this study showed that calves will develop a typical flora if not rigidly isolated from the barn where mature cows are kept.

Some of the calves were housed apart from their dams but handled by the same herd workmen, as is normal. Some of the groups of rumen *bacteria* (the flora) typical of mature cows were found among the predominant organisms in these calves at 3 weeks, more at 6 weeks, and all by 9 to 13 weeks. Inoculation (drenching with rumen contents from an adult cow) failed to speed development of these bacteria.

Three groups of *protozoa* (the fauna) that occur in mature cattle did not develop in these calves under normal rearing. When later put with the mature herd, the calves acquired these protozoa, but it took another several weeks for them to become well established. Calves raised under the same conditions but inoculated with rumen contents from mature animals did develop the protozoa. These began to appear as early as 3 weeks and were well established by 6 to 9 weeks of age.

Calves rigidly isolated from the mature herd to 17 weeks of age didn't have any of the 3 protozoan groups or large numbers of any but 1 of 9 bacterial groups ordinarily predominant in a cow's rumen.

Many bacteria that don't thrive in the presence of normal rumen microflora were among the predominant bacteria in the rigidly isolated calves. Some normal rumen bacteria such as cellulolytic cocci were present in these calves, but not in dominant numbers until after the animals were inoculated. This suggests that some normally dominant rumen bacteria are present in isolated calves but fail to thrive without the help of factors supplied by other organisms normally present.

ARS bacteriologist M. P. Bryant and associates found calves were equally thrifty whether rigidly isolated or not and irrespective of the type of flora and fauna. Isolated calves ate as much roughage and apparently assimilated it just as well as calves raised normally and having normal rumen bacteria. Isolated calves in this limited study showed no noticeable difference from unrestricted ones in rate of growth, appearance, or in feed efficiency through 17 weeks. ☆

How to select sheep...



It pays to center attention on a few highly heritable traits of economic importance, pick young herd rams yearly



■ SHEEP SELECTION METHODS haven't changed much in 3,000 years, but more effective application is bringing farmers better sheep and more money. Careful use of methods has already improved many important qualities—fleece and weaning weights, staple length, face covering.

Selection should be made for as few traits as possible; progress decreases as number of traits increases. This is apparent from breeding work by USDA animal husbandman C. E. Terrill, ARS Agricultural Research Center, Beltsville, Md., and researchers at the U. S. Sheep Experiment Station and Western Sheep Breeding Laboratory, Dubois, Idaho, in cooperation with Idaho Agricultural Experiment Station.

Traits with high economic importance should be emphasized. These include open face, twinning or number of lambs weaned, heavy weaning or market weight, long staple, and heavy fleece. Highly heritable traits such as open face or staple length can be improved most rapidly and should be emphasized. These traits have estimated heritability of 40 to 50 percent compared with 30 to 40 percent for weaning and fleece weights, and 10 to 20 percent for twinning or lambs weaned.

Index helps make selections for combination of factors

Emphasis on each trait can best be determined by calculating an index based on economic importance, heritability, and relationships between traits. An index combines all the factors to be considered. It's the best way to select for several traits at the same time (see chart below).

Range varies with number of animals tested---more animals, greater range. Scores tell where animal stands on any one trait within the flock. Scores differ depending on breed and conditions under which flock is kept. (Figures obtained on a flock of Rambouillet weanling lambs.)

TRAIT		RATING	CONSTANT	SCORE
Weight		79.4 lb.	+ 1	= +79.4
Neck folds	RANGE 1 to 3	1.3	X -11	= -14.3
Face covering	RANGE 2 to 5	3.1	X -15	= -46.5
Staple length	RANGE 2.5 to 5.5	4.0cm.	X +7	= +28.0
Conformation	RANGE 1 to 4	2.4	X +4	= +9.6
Fatness	RANGE 1 to 4	2.6	X +8	= +20.8
				+77.0

Scientists determine these figures on basis of heritability and economic value of traits. These figures are pre-determined to give each trait proper emphasis in overall score. Figures have plus or minus values depending on relationships among traits and whether smaller values indicate increasing merit.

Highest scoring animals in flock are most valuable for breeding.

Selections may be confused by nonhereditary differences—such as those caused by feed and care, age of dam, type of birth (twin or single), and age when selection is made. For example, a single-born lamb may weigh 12 pounds more at weaning than a lamb born and raised as a twin. Twins raised as single lambs may weigh 6 pounds more. In addition, offspring of mature dams may weigh 7.5 pounds more at weaning than those of 2-year-old dams. Age is important because lambs of weaning age are increasing in weight by about half a pound daily.

Corrections must be made for nonhereditary differences

Disregarding these differences tends to result in selecting older and single lambs, and lambs from mature ewes. These are heavier than younger lambs, twins, and lambs from 2-year-old dams—but no better genetically. Corrections for these nonhereditary factors can be incorporated in an index. Or a farmer may select breeding stock from within a group of singles or twins, early or late lambs, and so on.

Selection of rams is important and in one study was found to account for 80 to 90 percent of all gains from selection. As few rams as possible should be used, and these should be selected from as large a group as possible. It's not as important to select ewes going into a breeding group to produce rams as it is to select among rams produced from the group. Pen mating isn't necessary for improvements from selection but may help determine gains from purchased rams.

Terrill thinks it's advisable to use the best *yearling* rams—sometimes the best ram *lambs*—each year. It's true that sires can be accurately evaluated by testing their progeny. But breeders may make greater progress by going ahead and using the yearling rams and ram lambs rather than waiting for the results of these progeny tests.

Gains from selection of ewes come mostly through raising the quality of the flock by getting rid of low-producing ewes early in life.

Ewes should be selected at yearling age for economically important traits like open face, staple length, fleece weight, and body weight. Ewes with open faces have been shown to wean 11 pounds more lamb per year and 11 percent more lambs per ewe than those with covered faces (AGR. RES., March 1956, p. 12). Longer staple length and heavier fleece weight mean more and better wool, and ewes with these qualities are valuable for breeding. And finally, ewes that are heavier at yearling age produce more pounds of lamb than lighter ewes.

Lamb production emphasized for ewes past yearling age

After yearling age, ewes should be selected largely on the basis of lamb production, except for such culling as is necessary for unsoundness and age. Ewes that fail to raise lambs in their first 2 or 3 years should often be eliminated. It pays also to select for twinning. In Terrill's work, ewes that had twins weaned an average of about 40 pounds more lamb per year than ewes that had single lambs.

Methods will vary with kind and size of enterprise. Commercial producers of lambs and wool can gain by early elimination of low-producing ewes. Large breeders can apply more detailed procedures to small, select flocks to produce rams for the rest of the flock, from which sale rams or ewes are produced. Breeding animals should be selected under range or feed conditions that offspring will encounter. ☆



Researchers are seeking a way to improve utility of cattle leather by modifying hard elastin membrane

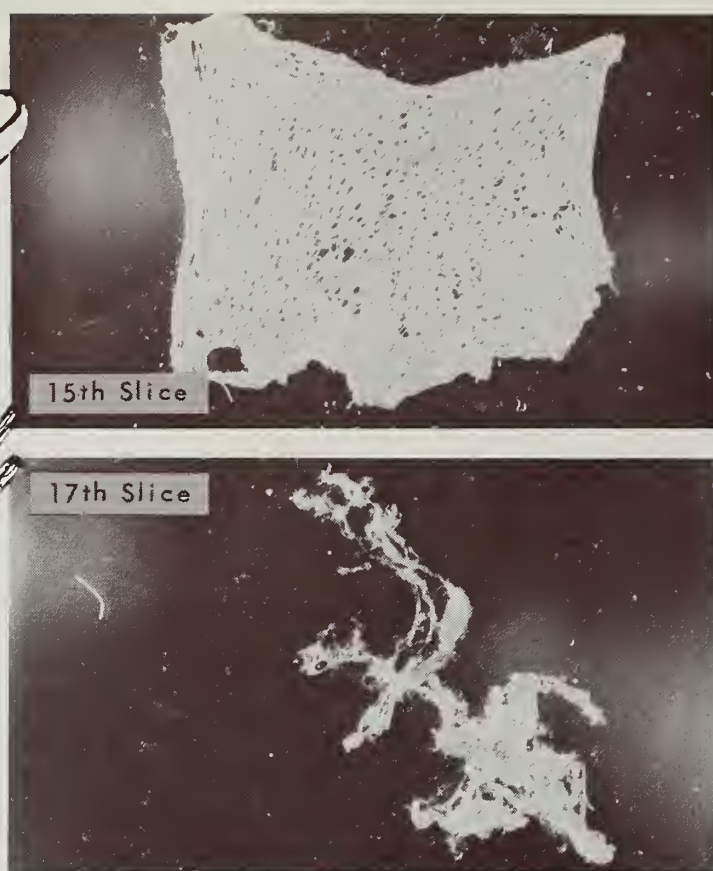
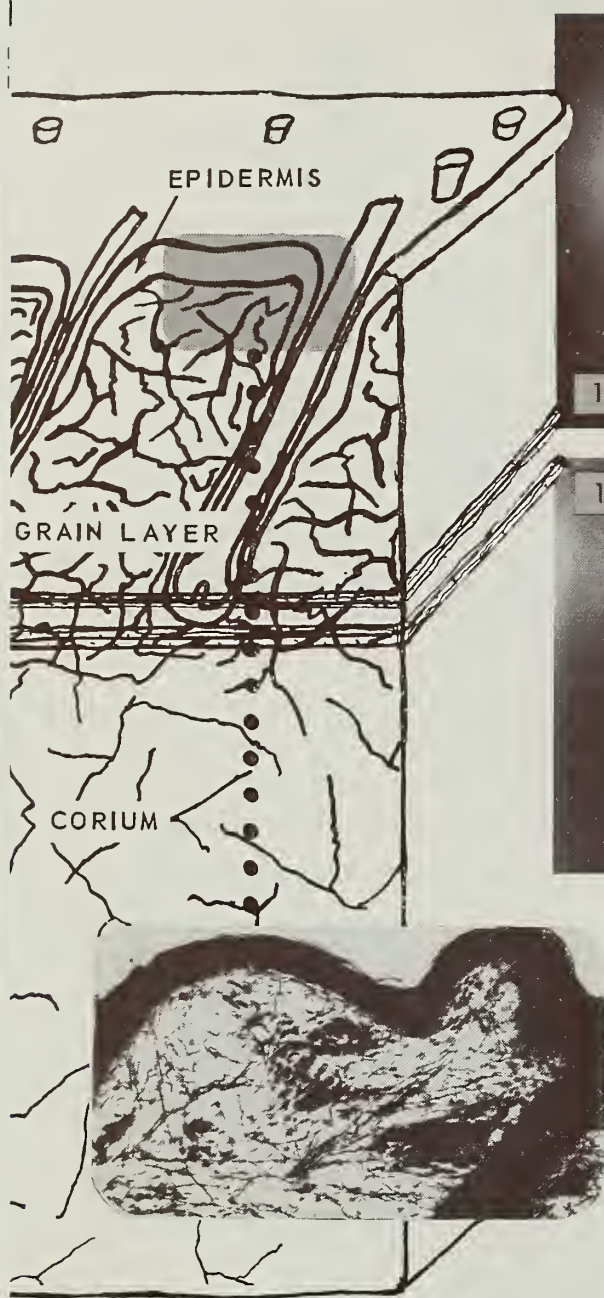
■ NEW AND WIDER areas of research for improving leather quality and utilization are opening up with intensive USDA study of a condensed layer of membrane found in cattle hide.

This membrane, known as elastin, is the yellow connective protein tissue found in ligaments of all muscular tissue as well as in hides. Although elastin has been isolated from muscular tissue for some time, it has only recently been isolated from cattle hide in experiments by ARS researchers.

Elastin is easily digested by enzymes but is resistant to chemicals. It stretches without breaking when wet and is brittle and hard when dry. Tanning agents do not affect it.

Elastin may affect cracking

These properties of elastin affect leather quality for certain applications. For instance, one of leather's best features is its flexibility. Paradoxically, one of the industry's biggest problems is the fact that leather frequently cracks when it is bent.



FILMY structure of elastin shows in the horizontal slices cut from grain layer. Filminess persists to about the 15th slice (top), at depth of deepest hair follicles. Residue of 17th slice (bottom) is mostly disintegrated. Grain layer was sliced to analyze location and distribution of elastin membrane (slices only 0.04 inch thick). Cross-section diagram (left) shows clearly distribution of elastin in cattle hide. Grain layer contains a network of many fibers; corium shows only a few, widely spaced. Large diagonal bands are hair follicles—enlarged photo shows follicle in greater detail. Enlargement also shows fibers as they appear in cattle hide. The elastin fibers vary somewhat in thickness.

Researchers know that dry elastin cracks also. They know, too, that elastin is present in cattle hide. And they suspect a strong relationship between elastin and the ease with which cracks form in the leather.

By isolating and studying this membrane layer, chemists E. F. Mellon and A. H. Korn will now be able to do two things with leather for the first time:

Way opened for direct study

First, they can study chemical and physical properties of elastin directly from cattle hides. Known properties of this material were obtained by studying elastin from ligaments. And although scientists believe elastin from cattle hide and ligaments to be similar, they will be able to pin down the exact properties of the newly isolated material from further studies.

Second, scientists will also be able to see exactly how removal of elastin affects leather properties. It may be possible to obtain softer and more pliable leathers that would have widespread application for fine clothing. Research along these two lines is now

underway at the Eastern Utilization Research and Development Division, located near Philadelphia.

Researchers previously thought the fine fibers comprising elastin were concentrated near the hide surface. It was found to be generally distributed throughout the grain layer (hide section extending from the surface to a point slightly below the deepest hair follicles). Concentration appears highest at about one-third the depth of the grain layer. The dense membrane is formed when the elastin network collapses after removal of other constituents found in the hide.

This study is part of continuing USDA efforts to increase utilization of leather by chemically modifying hides to give them new properties, and by developing better, faster, and cheaper handling and tanning methods. Our domestic and foreign leather needs are keeping pace with output. But this situation may not last long, owing to competition from other countries and inroads from leather-substitute industries. So it is important to find still wider uses, and find them soon. ☆



SOFTER and more flexible leathers may be developed by removal of elastin from grain layer of cattle hides. Elastin was removed from hide sample 2 with commercial enzyme (trypsin) with remarkable results. Surface layer became transparent, fine-grained, and less elastic—thus more desirable for use in clothing. Untreated control sample 1 keeps elastin network and typical grainy surface.

Effect of soil warmth

Corn comes up quicker, grows faster, and matures earlier when soil temperature is *raised*—up to an optimum of about 75° F.—cooperative experiments by USDA and Iowa Agricultural Experiment Station show.

This finding may have an important bearing on our further study of corn mulching, a practice that tends to reduce temperature. Despite its excellent effect on soil and water conservation, mulching has not been widely accepted for corn production in humid areas because of the frequently lower corn yields under mulch tillage. This temperature lowering by mulch may be a main cause of the poor early growth and low yields. Temperature reduction slows decomposition of the mulch, too, and retards nitrogen release to the soil and the crop.

Of course, soil- and water-conservation needs often outweigh the advantages of warmer unmulched soil.

Weedkillers for legumes

Two new selective herbicides may give us the long-sought control over weeds where legumes are grown.

Weed competition is an obstacle in getting legumes started and keeping them thrifty. Herbicides now used in grains can't be used where a crop is underseeded with legumes.

The new herbicides are 4-(2,4-DB) and 4-(MCPB)—fully identified as 4-(2,4-dichlorophenoxy)butyric acid and 4-(2-methyl-4-chlorophenoxy)butyric acid respectively. After studying these chemicals for 2 years, weed researchers at USDA's Agricultural Research Center, Beltsville, Md., and at cooperating State experiment stations reported that both chemicals gave excellent control of mustard, pig-

weed, lambsquarter, ragweed, and other weeds at rates of application that did little or no injury to young seedlings of lespedeza, alfalfa, red and Ladino clovers, flax, corn, and small grains underseeded with legumes.

The compounds differ somewhat in selectivity. For example, 4-(MCPB)



was more toxic to alfalfa but less toxic to flax under 4-2,4-DB).

These chemicals are being given limited farm trials this year in legumes grown for seed production but are not yet available for general farm use. Further study will be necessary before they can be applied to food or feed crops and suggestions can be made for general farm use.

Two other experimental herbicides, not commercially available, are promising for preemergence use. Simazine—or 2-chloro-4,6-bis (ethyl amino)-S-triazine—was especially effective in corn. And EPTC—or N-N-di-*n*-propylthiocarbamate—was effective in white and red clover, alfalfa, birdsfoot trefoil, soybeans, peanuts, corn, and other crops under test.

Cloth sheds oil and water

A new cotton fabric that sheds oil and water has been developed by USDA chemists at the ARS Southern Utilization Research and Development Division, New Orleans, utilizing commercially available materials.

Two treatments—both based on fluorochemicals—give these results. In one treatment, cotton fabric is passed through a colorless latex-polymeric ester and dried. In the other treatment, a chemically altered com-

plex of a fatty acid is padded onto the fabric, then air or oven dried. White fabric turns a very pale green with the latter treatment, but not enough to affect dyed fabric.

Oil, which readily penetrates untreated cotton fabrics, will not penetrate the treated fabric—will even roll off of it after 2 weeks of contact. And water drops stand up on the treated cloth until evaporated.

Color, appearance, and feel of the cloth are unchanged by these treatments, although the colorless latex-polymeric ester adds some weight and makes the fabric gather dirt. Fabrics treated with the chemically altered complex of a fatty acid are as resistant to soiling as fabrics treated with present commercial antisoiling agents. The process is still in the pilot-plant stage and current work is directed toward development of a fluorochemical surface layer that is resistant to soiling and likewise colorless.

Nicarbazin for chickens

Nicarbazin is effectively used to prevent coccidiosis in chickens. But this drug can reduce hens' egg production by as much as 50 percent under some conditions. And it can change egg color from brown to white.

Nicarbazin was fed to New Hampshire laying hens in tests at USDA's Agricultural Research Center, Beltsville, Md., to check its effects on egg production, quality, and weight, and shell color and thickness.

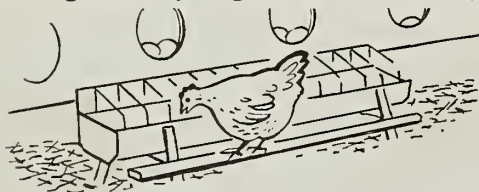
ARS parasitologists D. K. McLoughlin, E. E. Wehr, and R. Rubin fed 30 hens for 3 weeks on mash medicated with 0.0125 percent nicarbazin; 30 other birds served as controls.

Egg production of hens fed nicarbazin was greatly reduced. During the second week, treated hens laid only

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half as many eggs as the untreated controls. This difference was kept up until more than a week after the nicarbazin was discontinued. Two weeks after the drug was withdrawn, hens were back to normal production—sometimes even above it.

Brown eggs began to lighten within 3 days after birds were given nicarbazin, and after 2 weeks were white. Then the drug was withdrawn. Brown color gradually began to return 2 days



later and was completely normal by the end of 14 days under study.

No significant differences were found in weight, quality, or shell thickness of eggs produced by treated and untreated hens. Researchers elsewhere, however, found that treated hens produced mottled yolks.

Soybean grower cautioned

Farmers whose land is infested with the soybean cyst nematode can do themselves and the public a service by not planting that land to crops that build up or lead to spread of the pest. That includes soybeans, snap beans, lespedeza, common vetch, and crops that generally move off the farm with soil attached (vegetable seedlings, bulbs, and root crops).

Soil clinging to farm tools, machinery, vehicles, used sacks, boxes, or crates can also carry the nematode.

Washing or otherwise removing such soil helps reduce the hazard.

Pending outcome of a national survey to find all infestations, this pest is found in New Hanover and Pender Counties, N. C., Lake and Dyer Counties, Tenn., Pemiscot County, Mo., and Mississippi County, Ark.

Planning better nutrition

"We can't do today's work with yesterday's tools and be ready to meet tomorrow's problems." With this plea, nearly 200 nutritionists from all parts of the country urged a new, positive approach to nutrition teaching and creation of new teaching aids.

The scientists recommended nutrition education aimed at habit forming rather than information for all age groups. Preservice and inservice training for teachers and other professional leaders was emphasized as was research on ways to make nutrition education more effective. Regional and local conferences, it is hoped, will plan for work locally.

The Nutrition Education Conference was held in Washington, D. C., April 1-3. It was sponsored by USDA's Nutrition Committee and the Interagency Committee on Nutrition Education and School Lunch.

Fruit-thinning spray

There may yet be a brighter future for chemical thinning of fruit, a once-promising method that fell short on fulfillment. By adding a detergent,

USDA has boosted the effectiveness of the hormone spray NAA in much lower and less injurious concentrations than customary.

NAA (naphtholeneacetic acid) has been extensively used in eastern orchards for a few years with variable results. Used alone, it will thin most varieties of apples if applied 10 to 15 days after petal fall.

ARS plant physiologist C. P. Harley found in experiments at the Agricultural Research Center, Beltsville, Md., that adding the detergent Tween 20 (polyoxyethylene sorbitan monolaurate) to the hormone made it penetrate much better. When NAA was tagged with radioactive carbon 14, nearly 6 times as much carbon penetrated apple leaves in 48 hours with the detergent as without it. And as little as 2 to 5 p. p. m. of NAA with the detergent was as effective as 20 to 30 p. p. m. of NAA alone.

Further study showed this combination did an effective job of fruit thin-



ning when applied 10 days to 2 weeks after petal fall. NAA alone at 20 p. p. m. causes considerable "flagging" from which recovery is slow. Reduced concentration with Tween 20 greatly reduced the injury.

This treatment has not yet been extensively tested away from Beltsville. So it is suggested that growers use the formulation on an experimental basis.

